

Microhole Downhole Drilling Tractor

DE-PS26-03NT15475

Goal

The project goal is to design, manufacture, and demonstrate a reliable and economical, hydraulically powered coiled tubing (CT) tractor that will transport the drillbit and bottomhole assembly into long (>3,000 feet) horizontal well sections.

Performer

Western Well Tool, Inc.
Anaheim, CA

Results

The baseline design of a 3¼-inch Microhole Drilling Tractor (MDT) was completed. Experiments were conducted with low-solids drilling mud that verified component functionality and operational life.

Work started on a redesign of the MDT. The MDT is being completely redesigned with a 3⅝-inch outside diameter. This allows a greater inside diameter for flow to the downhole motor and drillbit, for returning cuttings to the surface, and for improved hole cleaning.

Improved start-stop valve and gripper designs are being developed. Long-lead items are being designed and released on a priority basis to shorten manufacturing times.

Benefits

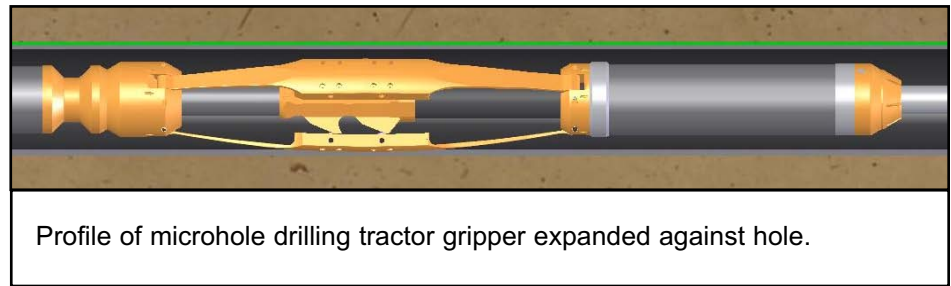
The MDT will allow drilling of horizontal holes up to 2,000 feet beyond conventional CT drilling.

Using CT and the MDT can be 25-50% less expensive than rotary rigs in some applications, especially in environments where set-up time is costly.

Controls are simple and direct using the injector and pump pressure, thus eliminating need for expensive electrical controls.

The MDT is capable of high loads (3,500+ lbs) through dog-legs up to 15 degrees per 100 feet.

Grippers for tractor movement are highly reliable, have a long life (>175,000 feet traveled before maintenance), are highly



debris- and fluid-tolerant, can efficiently traverse washed-out hole sections, do not damage casing, and are proven to operate in both very soft and hard formations.

Using a simple principle of operation, power is provided by differential pressure of the drilling mud at the tool.

Background

Although there are many advantages of CT drilling, one area of needed technology development is a method to exert enough weight on the bit to drill through rock. Coiled tubing easily buckles, which makes it difficult to impart drillbit weight. One technology that has been recently developed to overcome this problem is a downhole tractor that thrusts the drillbit into the formation while pulling the coiled tubing along behind.

Summary

The MDT to be designed and manufactured is a drilling fluid-powered unidirectional downhole CT tool. The tractor outside diameter will be 3⅝ inches to accommodate 3⅝-inch holes, and the tractor will be able to drill >3,000 foot horizontal well sections.

The MDT builds on previously developed Western Well Tool Tractor technology that has demonstrated the capability to operate downhole with a variety of drilling muds, operating parameters, and drilling equipment. The tractor consists of a central control assembly that directs the mud flow and provides the pull and thrust of the tractor and a forward and aft shaft assembly with patented grippers that operate successfully in soft and hard formations.

The microhole tractor walking process consists of several steps. A forward roller-toe gripper is expanded (inflated) against the walls of the hole, thrusting the bit forward and pulling the coiled tubing as the tractor progresses. The forward roller-toe gripper deflates while the aft roller-toe gripper expands against the hole wall, pushing the bit forward and pulling the drillstring into the new position. This process repeats, allowing the tractor to “walk” down the hole while drilling in front of the tractor and pulling the drillstring behind it.

In the first phase of the project, a drilling tractor will be designed that is reliable, economical, field-ready, and can drill horizontal well sections of 3,000 feet or more. In the second phase of the project, a prototype drilling tractor will be built and field-tested to demonstrate its performance with a CT rig by drilling multiple inclined and horizontal holes.

Current Status (December 2005)

Design of the major components, including the control assembly, grippers, and shaft assemblies is nearing completion. Procurement will begin in first quarter 2006, with the long-lead items ordered on a priority basis.

A three-well demonstration program is scheduled for fourth quarter 2006.

Project Start / End: 7-1-04 / 8-22-06

DOE / Performer Cost: \$795,515 / \$189,879

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